Hydrology and Earth System Sciences Discussions

Interactive comment on "CREST-Snow Field Experiment: analysis of snowpack properties using multi-frequency microwave remote sensing data" *by* T. Lakhankar et al.

Anonymous Referee #2

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This manuscript presents the analysis of snowpack properties using the observations from multi-frequency passive microwave remote sensing dataset and combination of physically based (mass and energy balance) snow model (SNTHERM) and radiative transfer model (HUT snow emission model). The content of the manuscript is of great importance in microwave remote sensing and snow modeling community. But, the manuscript is too unclear in its presentation. It is difficult to follow the manuscript. The manuscript should be revised to make it acceptable for publication in HESS. Suggestions are listed below.

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Comments/Suggestions

1. Objectives of this paper are not clear. Please clearly state in Introduction.

2. The major issue is the snow grain size and snow density observation. After multiple reading of manuscript, it seems that the snow grain size and density were measured for only one day (10 March 2011). Later, the simulated values of grain size and density (from SNTHERM model) were used to estimate brightness temperature through radiative transfer model (HUT snow emission model). This raises the question about the outcome of this paper; analysis of snowpack properties from microwave remote sensing? All the discussions about snowpack properties (except snowpack temperature) in chapter 4.1 and 4.2 would become purely subjective. Please clarify it clearly. I think this is the key issue of this paper.

3. Please specify the dimension of microwave radiometer footprint.

4. Give details of the 4 point calibration and non-linear transfer function

5. How the authors obtain surface energy fluxes from NSM model. How the authors provide forcing/input data to NSM model. What is the run period for NSM model

6. Terminologies were quite unclear: snow accumulation phase, late winter period. It is better to show the snowfall events in figures 3, 4, 5 to understand clearly the effect of fresh snowfall events on brightness temperature and snowpack temperature.

7. As mentioned already, the direct analysis of snowpack property is the only snowpack temperature. I am not satisfied with the terminology used "snowpack properties" in Page 8112, line 25 (Figure 3 illustrates. . . . .). Please have modification of sentences in other places too.

8. Causes for brightness temperature fluctuations at 89 GHz – Lines 12 to 17 are confusing sentences. Snowfall event and their transformation of shape (snowflakes) are responsible for increase of Tb? and Greater microwave scattering for increase of Tb?

9. Page 8116, lines 4-5., higher relative humidity cause relatively higher sensible heat flux, how?

10. Pate 8116, lines 9-10, "increased sensible heat flux of approximately 100 Wm-2 brought the snowpack temperature to above freezing level". This sentence is technically incorrect, as snowpack temperature cannot be above freezing level. Please clarify.

11. Fig 6: a)Fresh snow (LD) and b)Fresh snow (HD), Please use full form; low depth and high depth for LD and HD

12. Simulation of Tb – What is the purpose of simulation of Tb? The authors want to say that the output of SNTHERM can be used for snow emission model in simulating Tb? Please state clearly in introduction part and in chapter 4.3.

13. Table 4 is unclear. Either the authors should provide the simulated and observed Tb in separate columns or the authors should provide bias between these two values.

14. Page 8119, line 20. Figure 7 should be figure 8. Figure 8 is also too qualitative. Please show the time series of simulated and observed Tb for the entire period (3 phases as the authors discussed in chapter 4.1. Then we can have more insight in the causes of biases between the simulated and observed Tb.

15. There are a number of grammatical errors that, though minor, together detract from the quality of the manuscript. These need to be corrected before publication. I recommend asking a native English speaker to carefully edit for grammar.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 8105, 2012.

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